

### STUDIES IN THE SENECEIONEAE (ASTERACEAE). III.

#### THE GENUS PSACALIUM

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A distinctive group of mexican Senecioneae has been rather consistently separated from Senecio by various authors on the basis of the white flower color and the lack of rays. The species have been placed under the genus Cacalia by many authors though the latter name actually must be applied to a completely different group of plants (Rydborg, 1924; Cuatrecasas, 1960). The particular group of mexican "Cacalioid" Senecioneae considered here are the perennial subscapose herbs with corolla lobes separated to the tube. These species have been treated by Rydborg (1924) and Pippen (1968) as two genera, Psacalium having peltate leaves, and Odontotrichum lacking peltate leaves. Recent observations have provided the basis for a number of refinements over the concepts of previous authors.

Previous concepts have recognized in only a general way some basic distinctions within the Senecioneae of Mexico. The most recent efforts of Pippen (1968) have indicated the polyphyletic nature of the so-called "Cacalioid" group in relation to what has been called Senecio. The concept is simplified by the discovery that the "Cacalioid" genera with some elements of Senecio belong in a series having single fused stigmatic lines on each style branch and lacking any specialized enlargement at the base of the anther collar. As such, the series is clearly distinct from typical Senecio. In the series some segregates treated by Pippen (1968) such as Digitacalia stand clearly apart by the caulescent habit and the thickenings on the transverse walls of the exothecial cells. Odontotrichum and Psacalium, the two segregates of subscapose herbs with corolla lobes separate to the tube, however, seem to form a single unit with some species such as O. radulifolium being transitional. There is no evidence yet that any of the hybridization in the complex occurs between members of the two different genera but the close relationships suggest that such examples might be found. The present view is that the two groups of species should be treated as a single genus under the older name Psacalium.

The general relationships of Psacalium indicate some predisposition toward palmate and even peltate leaves in the group. On this basis one cannot assume the forms with peltate leaves are necessarily the more derived forms or that they are monophyletic.

Still, an analysis of diversity in the genus might favor the non-peltate forms as ancestral. Certainly, the most divergent element in the genus is the non-peltate leaved P. paucicapitatum which has flocculent pubescence, an erect globose fleshy corm and a subracemose inflorescence.

Other characters besides petiole attachment seem to vary in the genus. Contrary to previous accounts the flowers are sometimes yellow as in P. matudae described below. Also, some species completely lack a pappus, some have a very short pappus and one has a pappus falling before maturity. Previous authors have quite properly treated these pappus variations as only species differences.

The review of material in the U.S. National Herbarium and some specimens kindly loaned by the New York Botanical Garden and Cornell University, has indicated additional need for changes in species concepts. The species reviewed include two new to science, two resurrected from synonymy and one raised from varietal rank. Differences from the Pippen treatment are largely the result of seeing additional material but in some cases opinions differ as to the value of various characters. Pippen has provided evidence of hybrid origin in Odontotrichum scabrum Rydb. ( P. globosum x P. sinuatum ), but in all other cases where definite differences can be demonstrated species are maintained in this study. In view of the many alterations a new key to the unified genus concept has been prepared. The range is extended to include Guatemalan species and some alternative subdivisions to those used in Pippen's key are provided.

#### Key to the species of Psacalium:

1. Inflorescence rather elongated, paniculate or thyriform to subracemose with heads sometimes nodding 2
1. Inflorescence broadly corymbose or cymose, usually with congested or subfasciated primary branching 12
2. Leaves not peltate; stems, undersurface of leaves and outer surface of phyllaries covered with dense flocculent pubescence; tips of pappus setae enlarged with enlarged cells; plants from enlarged erect globose corm  
P. paucicapitatum
2. Leaves peltate; pubescence coarse to lacking but not densely flocculent; tips of pappus setae pointed, not enlarged; plants from a compact usually creeping fleshy rhizome 3

3. Achenes pubescent 4
3. Achenes glabrous 6
4. Heads erect without prominent subinvolucral bracts;  
pappus 6-7 mm long P. eriocarpum
4. Heads nodding, with numerous prominent subinvolucral bracts;  
pappus mostly 8-10 mm long 5
5. Leaves deeply lobed with lobes usually deeply bilobed;  
phyllaries bearing many long coarse setae P. matudae
5. Leaves shallowly lobed to less than half way to center;  
phyllaries bearing only very short setae and glandular hairs  
P. holwayanum
6. Heads usually with 5 flowers and 5 phyllaries 7
6. Heads with 8 or more flowers and phyllaries 9
7. Stems densely villous; leaves dense long villous below;  
corollas 12 mm long P. pinetorum
7. Stems and leaves short pubescent; corollas 6-9 mm long 8
8. Phyllaries densely pubescent on outer surface; lower surface  
of leaves variously pubescent with rather coarse hairs  
P. megaphyllum
8. Phyllaries essentially glabrous; lower surface of basal  
leaves densely pubescent with fine very thin-walled hairs  
P. tabulare
9. Heads with 8-12 flowers 10
9. Heads with 20 or more flowers 11
10. Lamina of basal leaves mostly 4-12 cm across, nearly glabrous  
below; inflorescence very lax P. laxiflorum
10. Lamina of basal leaves up to 40 cm across, covered with  
numerous fine hairs below; heads in dense clusters  
P. nelsonii
11. Lower surface of basal leaves densely long tomentose, lamina  
lobed less than half distance to center; inflorescence  
without broadened petioles or broad pedicellar bracts  
P. mollifolium

11. Lower surface of basal leaves with sparse or short rather coarse hairs, lamina lobed about 2/3 distance to center; inflorescence with broadened petioles on upper leaves and some broad bracts on pedicels P. peltatum
12. Basal leaves peltate or subpeltate 13
12. Basal leaves not at all peltate or subpeltate 19
13. Pappus lacking 14
13. Pappus present 15
14. Leaves dissected into very slender branching lobes; plants without underground tubers P. calvum
14. Leaves with sharply toothed lobes over 5 mm broad; plants with fleshy underground tubers attached to caudex P. nanum
15. Achenes glabrous, upper cauline leaves with slender petioles 16
15. Achenes pubescent, upper cauline leaves with expanded petioles 17
16. Basal leaves angulate, not lobed; stem hirsute P. hintonii
16. Basal leaves lobed half distance to center; stems glabrous or very sparsely hirsute P. peltigerum
17. Leaves broadly and shallowly lobed, sometimes centrally peltate, glabrous or with rather indistinct hairs below; phyllaries usually very blunt P. poculiferum
17. Leaves deeply lobed, always strongly excentric to subpeltate, with prominent short hairs on the veins below; phyllaries usually acute 18
18. Leaves thin, papery, lobes with regular sharp diverging segments distally P. quercifolium
18. Leaves thick, parchment-like, lobes with irregular short or blunt teeth or segments P. radulifolium
19. Pappus not longer than the corolla tube 20
19. Pappus longer than the corolla tube 24
20. Pappus 2 mm long or less, about half as long as the corolla tube 21

20. Pappus over 2 mm long, about as long as the corolla tube  
22
21. Petioles flattened, winged; basal leaves with lobes usually  
longer than broad P. brachycomum
21. Petioles subterete, not winged; basal leaves coarsely toothed  
or lobulate with lobules broader than long P. palmeri
22. Basal leaves toothed or subentire, not lobed; petioles stout,  
densely pubescent P. nephrophyllum
22. Basal leaves deeply pinnately or subpalmately lobed 23
23. Upper cauline leaves with broadly auriculate bases, the  
margins laciniate; pappus deciduous before maturity of  
achenes P. cirsiifolium
23. Cauline leaves without auriculate or laciniate-margined  
bases; pappus persistent P. cervinum
24. Achenes pubescent 25
24. Achenes glabrous 29
25. Heads large, 1.5-2.5 cm high with 40 or more flowers; corolla  
tube 7-10 mm long, twice as long as the lobes, pappus setae  
clavate distally P. platylepis
25. Heads smaller, 1.0-1.4 cm high or less; flowers 25 or less;  
corolla tube 3-5 mm long, about as long as the lobes;  
pappus setae not clavate distally 26
26. Phyllaries 10, sparsely pubescent; heads with 12-25 flowers  
P. napellifolium
26. Phyllaries 5-8, glabrous; heads with 5-14 flowers 27
27. Leaves deeply dissected or pinnatisect into linear segments,  
the ultimate segments linear or narrowly triangular, at  
least 5 times longer than broad P. filicifolium
27. Leaves shallowly or deeply lobed but not finely dissected or  
pinnatisect into linear segments, the ultimate segments  
triangular or deltoid, less than 3 times longer than broad 28
28. Heads with 9-14 flowers and 7-8 phyllaries; cauline leaves  
reduced, bracteiform, narrowly ovate, laciniate-lobed,  
8 cm long or less, 1-3 cm broad, the base not auriculate  
P. pringlei

28. Heads with 5-6 flowers and 5 phyllaries; cauline leaves broadly ovate, leafy, auriculate based, 11-20 cm long, 11-20 cm broad, the margin dentate or lobed  
P. tussilaginoide
29. Basal leaves deeply lobed 30
29. Basal leaves subentire to shallowly lobed 32
30. Heads with 6-8 flowers and 5-6 phyllaries; leaves 3-4-pinnatisect  
P. decompositum
30. Heads with 9-11 flowers and 7-9 phyllaries; leaves deeply dissected or pinnatifid but not cleft to midrib 31
31. Heads more cylindrical; lower pair of lobes on leaves not deflected downward  
P. multilobum
31. Heads turbinate; lower pair of lobes on leaves deflected downward  
P. sinuatum
32. Heads large with 30 or more flowers; phyllaries 13-14 33
32. Heads small with 15 or fewer flowers; phyllaries 8 or fewer 34
33. Bracts subtending the involucre oblong or obovate, distally lacinate, 3 mm wide; corolla tube 9-10 mm long, twice as long as lobes; phyllaries 12-15 mm long  
P. amplum
33. Bracts subtending the involucre linear-subulate, tapering to a point distally; corolla tube 5-6 mm long, slightly longer than the lobes; phyllaries 7-9 mm long  
P. pachyphyllum
34. Inflorescence very compact, globose with essentially sessile heads; phyllaries 5-6 per head  
P. globosum
34. Inflorescence tightly or loosely corymbose; heads distinctly pedicellate; phyllaries usually 7-8 35
35. Basal leaves with broad shallow lobes  
P. amplifolium
35. Basal leaves subentire to toothed, not lobed 36
36. Basal leaves deeply cordate; petioles of cauline leaves broadly leafy margined, base auriculate, clasping stem; corolla tube 5-6 mm long  
P. silphiifolium
36. Basal leaves obtuse to shallowly cordate at base, petioles of cauline leaves usually terete, base sometimes dilated but not auriculate; corolla tube usually 3-5 mm long 37

37. Leaves slightly discolorous, undersurface rather obscurely whitish; leaves with numerous hairs especially toward margins and sometimes on petioles P. purpusii
37. Leaf surfaces concolorous, petioles and blades essentially glabrous P. goldsmithii

The genus Psacalium contains the following 38 species.

Psacalium amplifolium (DC.) H. Robinson & R. D. Brettell, comb. nov. Cacalia amplifolia DC. Prod. 6: 328. 1838.

Psacalium amplum (Rydb.) H. Robinson & R. D. Brettell, comb. nov. Odontotrichum amplum Rydb. Bull. Torrey Bot. Club 51: 417. 1924.

Psacalium brachycomum (Blake) H. Robinson & R. D. Brettell, comb. nov. Cacalia brachycoma S. F. Blake, Contr. Gray Herb. II. 52: 58. 1917.

Psacalium calvum (Brand.) Pippen, Contr. U.S. Nat. Herb. 34: 417. 1968.

Psacalium cervinum (Rydb.) H. Robinson & R. D. Brettell, comb. nov. Odontotrichum cervinum Rydb. Bull. Torrey Bot. Club 51: 420. 1924.

Psacalium cirsiifolium (Zucc.) H. Robinson & R. D. Brettell, comb. nov. Odontotrichum cirsiifolium Zucc. Abhandl. Baier. Akad. Wiss. 1: 311. 1832.

Psacalium decompositum (A. Gray) H. Robinson & R. D. Brettell, comb. nov. Cacalia decomposita A. Gray, Pl. Wright. 2: 99. 1853.

Psacalium eriocarpum (S. F. Blake) Blake, Journ. Wash. Acad. Sci. 28: 492. 1938.

Psacalium filicifolium (Rydb.) H. Robinson & R. D. Brettell, comb. nov. Odontotrichum filicifolium Rydb., Bull. Torrey Bot. Club 51: 414. 1924.

Psacalium globosum (Rob. & Fern.) H. Robinson & R. D. Brettell, comb. nov. Cacalia globosa Rob. & Fern., Proc. Amer. Acad. 30: 119. 1894.

Psacalium goldsmithii (B. L. Robinson) H. Robinson & R. D. Brettell, comb. nov. Cacalia goldsmithii B. L. Robinson, Proc. Amer. Acad. 43: 45. 1907.

Psacalium hintonii (Pippen) H. Robinson & R. D. Brettell, comb. nov. Psacalium peltigerum var. hintonii Pippen, Contr. U.S. Nat. Herb. 34: 430. 1968.

Psacalium holwayanum (B. L. Rob.) Rydb., Bull. Torrey Bot. Club  
51: 372. 1924.

Psacalium laxiflorum Benth. Pl. Hartw. 41: 1841.

Psacalium matudae H. Robinson & R. D. Brettell, sp. nov.

Plantae erectae grosse herbaceae ad 1 m altae non ramosae. Caules, folia, pedicelli, bractae subinvolucris et squamae involucris dense stipitato-glandulosae sparsius valde hirsutae, folia basilaria vix glandulifera. Caules teretes nigricantes. Folia alterna remota superne decrescentia, petiolis 2-23 cm longis basaliter sensim distincte latioribus, laminis peltatis radiantibus 5-7 lobatis basilaribus usque ad 15 cm diam., lobis ad 7 cm longis 2 cm latis prope medium dichotomis apice breviter acutis, laminis foliorum superiorum 3-8 cm diam. plerumque 5 lobatis. Inflorescentiae terminales paniculatae ca. 35 capitatae; pedicellis 3-5 mm longis. Capitula campanulata ad 1.5 cm longa 4-6 mm lata; bractae subinvolucratae ca. 7-10 lineares usque ad 1 cm longae; squamae involucris 8-9 uniseriatae lineares 10-11 mm longae ca. 1.5 mm latae obscure virides; receptacula parum convexa glabra vel sparsim hirsuta. Radii nulli. Flores discorum ca. 11; corollae flavae 9-10 mm longae superne infundibulares, tubis ca. 6 mm longis, lobis ca. 3 mm longis linearibus; thecae antherarum ca. 3.5 mm longae, cellulis exothecialibus oblongis, parietibus lateralibus nodiferis; appendices 1 1/2 longiores quam latiores. Achenia cylindrica ca. 4 mm longa dense setifera; carpopodia subcylindrica, cellulis ca. 10 seriatis quadratis vel brevioribus; pappus ca. 8 mm longus facile deciduus biseriatus distincte scabrus, cellulis apicalibus argute acutis non incrassatis. Grana pollinis ca. 40  $\mu$  diam.

Type: MEXICO: Mexico: Tlatlaya y cernanias. En bosque claro, altitude 1700 m. Dec. 28, 1953. Matuda et al 30015 (Holotype US); Additional specimens: Mexico: Tezoloapan, Pelon de tres reyes. En ladera semihumeda, rocosa, en bosque de los pinos, 2900 m. Nov. 22, 1970. Matuda et al 38241; En ladera humeda, rocosa en bosque mixto de pinos y incinos, 3000 m. Nov. 22, 1970. Matuda et al 38252; Temascaltepec, Peñón. 1680 m. Oct. 17, 1932. Hinton 2143; Volcan. 1450 m. Nov. 3, 1932. Hinton 2487 (all US).

Psacalium megaphyllum (Rob. & Greenm.) Rydb. Bull. Torrey Bot. Club  
51: 374. 1924.

Psacalium mollifolium S. F. Blake, Journ. Wash. Acad. Sci. 28: 491.  
1938.

Psacalium multilobum (Pippen) H. Robinson & R. D. Brettell, comb.  
nov. Odontotrichum multilobum Pippen, Contr. U.S. Nat. Herb.  
34: 397. 1968.

Psacalium nanum Pippen, Contr. U.S. Nat. Herb. 34: 422. 1968.



Psacalium napellifolium (S. Schauer) H. Robinson & R. D. Brettell,  
comb. nov. Cacalia napellifolia S. Schauer, Linnaea 19: 732. 1847.

Psacalium nelsonii Rydb. Bull. Torrey Bot. Club 51: 374. 1924.

Psacalium nephrophyllum (Rydb.) H. Robinson & R. D. Brettell, comb.  
nov. Odontotrichum nephrophyllum Rydb. Bull. Torrey Bot. Club  
51: 418. 1924.

Psacalium pachyphyllum (Sch. Bip.) H. Robinson & R. D. Brettell,  
comb. nov. Cacalia pachyphylla Sch. Bip. ex Seem. Bot. Voy.  
Herald. 310. 1856.

Psacalium palmeri (Greene) H. Robinson & R. D. Brettell, comb. nov.  
Cacalia palmeri E. L. Greene, Pittonia 1: 219. 1888.

Psacalium paucicapitatum (Rob. & Greenm.) H. Robinson & R. D.  
Brettell, comb. nov. Cacalia paucicapitata Rob. & Greenm.  
Amer. Journ. Sci. III. 50: 158. 1895.

Psacalium peltatum (H.B.K.) Cass. Dict. Sci. Nat. 43: 461. 1826.

Psacalium peltigerum (Rob. & Seat.) Rydb. Bull. Torrey Bot. Club  
51: 374. 1924.

Psacalium pinetorum (St. & Stey.) Cuatr. Brittonia 8: 157. 1955.

Psacalium platylepis (Rob. & Seat.) H. Robinson & R. D. Brettell,  
comb. nov. Cacalia platylepis Rob. & Seat. Proc. Amer. Acad.  
28: 110. 1893.

Psacalium poculiferum (S. Wats.) Rydb. Bull. Torrey Bot. Club 51:  
375. 1924.

Psacalium pringlei (S. Wats.) H. Robinson & R. D. Brettell, comb.  
nov. Cacalia pringlei S. Wats. Proc. Amer. Acad. 25: 156. 1890.

Psacalium purpusii (Greenm.) H. Robinson & R. D. Brettell, comb.  
nov. Cacalia purpusii Greenm. Univ. Calif. Publ. Bot. 4: 95.  
1910.

Psacalium quercifolium H. Robinson & R. D. Brettell, sp. nov.  
Plantae erectae grosse herbaceae usque ad 1 m altae non  
ramosae. Caules puberuli teretes striati inferne rubescentes. Folia  
alterna plerumque basilaria superne decrescentia remota, petiolis  
basilaribus usque ad 20 cm longis dense puberulis inferne villosis,  
laminis peltatis valde eccentricis 7-15 cm longis et latis profunde  
9-11-lobatis, lobis 2-6 cm longis 0.8-1.5 cm latis, lobulis argutis  
divaricatis, sinibus late rotundatis, subtus distincte sparsim  
puberulis; petioli foliorum superiorum late laminati laciniati basi

valde auriculati, laminis diminutis vel nullis. Inflorescentiae terminales late corymbosae ca. 60 capitatae; pedicellis 3-8 mm longis sparsim puberulis. Capitula subcylindrica ca. 8 mm longa 2-3 mm lata; bracteae subinvolucris nullae; squamae involucris 4-5 anguste ellipticae 6 mm longae 1.5-2.0 mm latae extus glabrae. Flores discorum 4-5; corollae albae 7-8 mm longae, tubis 3.0-3.5 mm longis, lobis 4 mm longis linearibus; thecae antherarum ca. 2 mm longae; appendices 1 1/2-2 longiores quam latiores. Achaenia cylindrica ca. 3 mm longa dense setifera; carpopodia brevia, cellulis 3-4-seriatis; pappus ca. 5 mm longus facile deciduus biseriatus distincte scabrus, cellulis apicalibus argute acutis non incrassatis. Grana pollinis 30-35 $\mu$  diam.

Type: MEXICO: Sinaloa: Cerro de la Sandia, northeast of Panuco, Pacific slope. Pine forest, herb, flowers white. alt. 1700-1900 m. Aug. 29-30, 1935. Pennell 20085 (Holotype US).

The new species is related to Psacalium radulifolium and P. poculiferum. The latter species differs by the more shallowly lobed leaves with little or no pubescence below. The new species differs from P. radulifolium by the thinner texture of the leaves which are more translucent with a more evident fine netting of veins. The leaf lobes of the new species are more regular and generally sharper. The blade attachment is about 8-10 mm in from the margin while that of P. radulifolium is usually much closer.

Psacalium radulifolium (H.B.K.) H. Robinson & R. D. Brettell, comb. nov. Cacalia radulifolia H.B.K., Nov. Gen. et Sp., Folio ed. 4: 132, 1818.

Psacalium silphiifolium (Rob. & Greenm.) H. Robinson & R. D. Brettell, comb. nov. Cacalia silphiifolia Rob. & Greenm., Amer. Journ. Sci. III. 50: 158. 1895.

Psacalium sinuatum (Cerv.) H. Robinson & R. D. Brettell, comb. nov. Cacalia sinuata Cerv. in Llav. & Lex., Nov. Veg. Desc. fac. 1: 29. 1824.

Psacalium tabulare (Hemsl.) Rydb., Bull. Torrey Bot. Club 51: 375. 1924.

Psacalium tussilaginoides (H.B.K.) H. Robinson & R. D. Brettell, comb. nov. Cacalia tussilaginoides H.B.K., Nov. Gen. et Sp., Folio ed. 4: 132. 1818.

#### References

- Cuatrecasas, J. 1960. Studies on Andean Compositae-IV. Brittonia 12: 182-195.

Pippen, R. W. 1968. Mexican "Cacalioid" genera allied to Senecio (Compositae). Contr. U.S. Nat. Herb. 34 (6): 365-447.

Rydberg, P. A. 1924. Some senecioid genera I-II. Bull. Torrey Bot. Club 51 (9): 369-378; (10): 409-420.